

Claims

1. A fuel delivery pipe, in which a fuel inlet pipe connected to a fuel delivery body as a returnless type having an injection nozzle but not having return circuit connecting to a fuel tank is coupled to the fuel tank through an underfloor pipe arrangement, characterized in that:

a cross section shape in a perpendicular direction to an axis of the fuel delivery pipe, is formed in a substantially rectangular shape;

two wall surfaces at long sides of the substantially rectangular shape are respectively bent inwardly as formed in a double side concave shape;

a socket for connecting each injection nozzle is secured to either of two wall surfaces in a flat shape at short sides or either of two wall surfaces at long sides; and

a flexible absorbing wall surface is furnished by said two long side wall surfaces to absorb pulsation by deformation upon receiving pressure in association with fuel injection.

2. The fuel delivery pipe according to claim 1, wherein flat portions are respectively formed around centers of two long side wall surfaces.

3. A fuel delivery pipe, in which a fuel inlet pipe connected to a fuel delivery body as a returnless type having an injection nozzle but not having return circuit connecting to a fuel tank is coupled to the fuel tank through an underfloor pipe arrangement, characterized in that:

a cross section shape in a perpendicular direction to an axis of the fuel delivery pipe, is formed in a substantially flask shape, wherein a substantially rectangular shape is mounted on a top side of a trapezoid;

a socket for connecting each injection nozzle, is secured to either a bottom surface or an upper surface, or either of two side surfaces of the substantially flask shaped cross section; and

a flexible absorbing wall surface is furnished by two side surfaces of the substantially flask shaped cross section to absorb pulsation by deformation upon receiving pressure in association with fuel injection.

4. A fuel delivery pipe, in which a fuel inlet pipe connected to a fuel delivery body as a returnless type having an injection nozzle but not having return circuit connecting to a fuel tank is coupled to the fuel tank through an underfloor pipe arrangement, characterized in that:

a cross section shape in a perpendicular direction to an axis of the fuel delivery pipe, is formed in a shape of a substantial flask with a doom roof, in which a substantially rectangular shape is mounted on a top side of a trapezoid while a top

portion of the substantially rectangular shape is bent in an arc shape;

a socket for connecting each injection nozzle, is secured to a bottom surface or either of two side surfaces of the substantially flask shaped cross section; and

a flexible absorbing wall surface is furnished by two side surfaces of the substantially flask shaped cross section to absorb pulsation by deformation upon receiving pressure in association with fuel injection.

5. A fuel delivery pipe, in which a fuel inlet pipe connected to a fuel delivery body as a returnless type having an injection nozzle but not having return circuit connecting to a fuel tank is coupled to the fuel tank through an underfloor pipe arrangement, characterized in that:

a cross section shape in a perpendicular direction to an axis of the fuel delivery pipe, is formed in a reverted flask shape, wherein a reverted trapezoid is mounted on a top side of a substantially rectangular shape;

a socket for connecting each injection nozzle, is secured to a bottom surface of the reverted flask shaped cross section; and

a flexible absorbing wall surface is furnished by two side surfaces of the reverted flask shaped cross section to absorb pulsation by deformation upon receiving pressure in association with fuel injection.

6. A fuel delivery pipe, in which a fuel inlet pipe connected to a fuel delivery body as a returnless type having an injection nozzle but not having return circuit connecting to a fuel tank is coupled to the fuel tank through an underfloor pipe arrangement, characterized in that:

a cross section shape in a perpendicular direction to an axis of the fuel delivery pipe, is formed in a substantially trapezoid shape, wherein two hypotenuses of the substantially trapezoid shaped cross section are respectively bent inwardly;

a socket for connecting each injection nozzle, is secured to either a bottom surface or an upper surface, or either of two hypotenuses of the substantially trapezoid shaped cross section; and

a flexible absorbing wall surface is furnished by two hypotenuses of the substantially trapezoid shaped cross section to absorb pulsation by deformation upon receiving pressure in association with fuel injection.

7. A fuel delivery pipe, in which a fuel inlet pipe connected to a fuel delivery body as a returnless type having an injection nozzle but not having return circuit connecting to a fuel tank is coupled to the fuel tank through an underfloor pipe arrangement, characterized in that:

a cross section shape in a perpendicular direction to an axis of the fuel delivery

pipe, is formed in a shape of a substantial trapezoid with a doom roof, wherein a substantially trapezoid shape is formed and a top portion thereof is bent in an arc shape while two hypotenuses of the substantially trapezoid shape are respectively bent inwardly;

a socket for connecting each injection nozzle, is secured to a bottom surface or either of two hypotenuses of the substantially trapezoid shaped cross section; and

a flexible absorbing wall surface furnished by two hypotenuses of the substantially trapezoid shaped cross section to absorb pulsation by deformation upon receiving pressure in association with fuel injection.

8. A fuel delivery pipe, in which a fuel inlet pipe connected to a fuel delivery body as a returnless type having an injection nozzle but not having return circuit connecting to a fuel tank is coupled to the fuel tank through an underfloor pipe arrangement, characterized in that:

a cross section shape in a perpendicular direction to an axis of the fuel delivery pipe, is formed in a reverted trapezoid shape, wherein two hypotenuses of the reverted trapezoid shape are respectively bent inwardly;

a socket for connecting each injection nozzle, is secured to a bottom surface of the reverted trapezoid shaped cross section; and

a flexible absorbing wall surface is furnished by two hypotenuses of the reverted trapezoid shaped cross section to absorb pulsation by deformation upon receiving pressure in association with fuel injection.

9. A fuel delivery pipe, in which a fuel inlet pipe connected to a fuel delivery body as a returnless type having an injection nozzle but not having return circuit connecting to a fuel tank is coupled to the fuel tank through an underfloor pipe arrangement, characterized in that:

a cross section shape in a perpendicular direction to an axis of the fuel delivery pipe, is formed in a substantially key shape, wherein a substantially rectangular shape having a narrower width is mounded on a top side of another substantially rectangular shape;

a socket for connecting each injection nozzle, is secured to either a bottom surface or an upper surface, or either of two side surfaces of the substantially key shaped cross section; and

a flexible absorbing wall surface is furnished by two side surfaces of the substantially key shaped cross section to absorb pulsation by deformation upon receiving pressure in association with fuel injection.

10. A fuel delivery pipe, in which a fuel inlet pipe connected to a fuel delivery

body as a returnless type having an injection nozzle but not having return circuit connecting to a fuel tank is coupled to the fuel tank through an underfloor pipe arrangement, characterized in that:

a cross section shape in a perpendicular direction to an axis of the fuel delivery pipe, is formed in a shape of a substantially key with a dome roof, wherein a substantially rectangular shape having a narrower width is mounded on a top side of another substantially rectangular shape while the top portion of the substantially rectangular shape having the narrower width is bent in an arc shape;

a socket for connecting each injection nozzle, is secured to a bottom surface or either of two side surfaces of the substantially key shaped cross section; and

a flexible absorbing wall surface is furnished by two side surfaces of the substantially key shaped cross section to absorb pulsation by deformation upon receiving pressure in association with fuel injection.

11. A fuel delivery pipe, in which a fuel inlet pipe connected to a fuel delivery body as a returnless type having an injection nozzle but not having return circuit connecting to a fuel tank is coupled to the fuel tank through an underfloor pipe arrangement, characterized in that:

a cross section shape in a perpendicular direction to an axis of the fuel delivery pipe, is formed in a substantially goggles shape, wherein a substantially center portion of either of two long side wall surfaces of a substantially rectangular shape is inwardly bent as a concaved shape;

a socket for connecting each injection nozzle, is secured to the other substantially flat shaped long side wall surface or either of two flat shaped short side wall surfaces; and

a flexible absorbing wall surface is furnished by at least one long side wall surface having the substantially center portion bent as a concaved shape to absorb pulsation by deformation upon receiving pressure in association with fuel injection.

12. The fuel delivery pipe according to claim 11, wherein two long side wall surfaces are parallel.

13. The fuel delivery pipe according to claim 11, wherein either of two long side wall surfaces is formed as outwardly evaginated.

14. The fuel delivery pipe according to claim 1, 3, 4, 5, 6, 7, 8, 9, 10 or 11, wherein at least one of four corners of the cross section shape of the fuel delivery body is formed in the arc shape.

15. A fuel delivery pipe, wherein a fuel inlet pipe is connected to a fuel delivery body as a returnless type having an injection nozzle and no return circuit to a fuel tank,

and the fuel inlet pipe is coupled to the fuel tank through an underfloor pipe arrangement, characterized in that:

a flexible absorbing wall surface is formed on a wall surface of the fuel delivery body, wherein the absorbing wall yields to a change of internal pressure to render internal volume of the fuel delivery body increasable while α_L / \sqrt{V} determined by sonic speed α_L of fuel flowing through the fuel delivery body and the internal volume V of the fuel delivery body is set as $20 \times 10^3 (\text{m}^{-0.5} \cdot \text{sec}^{-1}) \leq \alpha_L / \sqrt{V} \leq 85 \times 10^3 (\text{m}^{-0.5} \cdot \text{sec}^{-1})$; and

a ratio α_L / α_H of equivalent sonic speed α_H in a high frequency area of the fuel flowing through an interior of the fuel delivery body to the sonic speed α_L of the fuel is set as $\alpha_L / \alpha_H \leq 0.7$.

16. The fuel delivery pipe according to claim 15, wherein α_L / \sqrt{V} is equal to $35 \times 10^3 (\text{m}^{-0.5} \cdot \text{sec}^{-1}) \leq \alpha_L / \sqrt{V} \leq 85 \times 10^3 (\text{m}^{-0.5} \cdot \text{sec}^{-1})$ while α_L / α_H is equal to $\alpha_L / \alpha_H \leq 0.7$.

17. The fuel delivery pipe according to claim 15, wherein α_L / \sqrt{V} is equal to $20 \times 10^3 (\text{m}^{-0.5} \cdot \text{sec}^{-1}) \leq \alpha_L / \sqrt{V} \leq 35 \times 10^3 (\text{m}^{-0.5} \cdot \text{sec}^{-1})$ while α_L / α_H is equal to $0.35 \leq \alpha_L / \alpha_H \leq 0.7$.

18. The fuel delivery pipe according to claim 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, or 15, wherein at least one portion of the fuel delivery body surfaces is formed as inwardly bent, so the bent portion yield outwardly to the change of the internal pressure, so that the absorbing wall surface can increase the internal volume of the fuel delivery body.